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## **ABSTRACT**

Electronic fire guard

Disclosed is an electronic fire guard for use in the vicinity of a fireplace comprising a sensor and alarm means, the sensor having transmitting and receiving means, for generating and monitoring an electromagnetic field around said sensor, wherein the sensor causes the alarm means to be activated when a disturbance in the electromagnetic field is detected.



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## Draft Patent Specification

## An Electronic Fire Guard

## 5 Field of Invention:

The present invention relates to an electronic fire guard. In particular, it relates to a device that utilises field disturbance sensing, suitably working in the microwave region of the electro-magnetic spectrum, to detect motion within the vicinity of an open fire, and activating  
10 an alarm when such motion is detected.

## Prior Art:

Open fires have been used since before recorded time. They are used for heating, food  
15 preparation and for their aesthetic effect. In recent decades their use has been reduced as other means of performing these functions have been introduced. For instance, oil fired central heating and gas cookers. The use solid fuel fires has also been curtailed by legal restrictions in some areas as a method of pollution control.

20 However, open fires are still widely used in rural and urban areas where such legal restrictions do not apply. Additionally, with the advent of clean burning gas and oil fires there has been a growth of natural flame effect fires in recent years. These fires normally use oil or gas fuel, and use a burner assembly covered with artificial logs or coals to create a natural fire effect.

25

Due to a fires incandescent nature it may be prudent in some instances to restrict access to the immediate vicinity of the fire. This can be achieved by use of a fireguard. Typically, these consist of a metal frame with a wire mesh constructed and placed in such a way as to prevent easy access to a fire. Their primary function is to prevent access by infants, young children  
30 or individuals either unable to appreciate the dangers posed by, or the consequences of interfering with an open fire. However, fireguards are sometimes not used. This may be due to the impact on the aesthetic effect of an open fire. Often a spark guard is used instead.

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- spark guard is of similar construction as a fireguard, but generally smaller and not as robust. A spark guards function is to prevent sparks or hot coals leaving the fireplace thus reducing the risk of an uncontrolled fire. Both fireguards and spark guards take away from a natural fire effect. They also contribute to heat loss as they reduce the amount of radiated heat entering the room area. A spark guard may also become hot enough to present a danger in it's own right. In the event that no fireguard or spark guard is in place there is no warning or indication when a fire is being interfered with, until physical harm ensues. Similarly, there is also no warning or indication when a fireguard or spark guard is being interfered with.
- 10 Conventional fireguards have two serious drawbacks. Primarily they are passive devices; that is, they can be interfered with or circumvented. This can lead to injury if the individuals to be restricted from the fire are at that time unsupervised. For example a child may circumvent a fireguard while the supervising adult is temporarily absent from the room. The only indication of this having occurred is upon discovery or cry of injury.
- 15 A means of warning that there is motion within the vicinity a fire would in some instances be useful. For instance, it would permit an adult supervising a young child to react proactively in the event that the child approaches the fire.
- 20 A field disturbance device is one means of implementing such a strategy. Such a device consists of a transmitter, which generates an emission of electro-magnetic energy and a receiver, which detects such emissions. The transmitter and receiver may exist as separate devices or as a single device depending on implementation. Objects subjected to the transmitted energy can affect its nature. The receiver detects such changes. One
- 25 implementation of this principle is a microwave field disturbance device. Objects within the microwave field can absorb and reflect the microwave energy. A subclass of these devices uses the same array for transmission and detection of microwaves. An oscillation is set up using returned energy to maintain a field. If there is movement within this field then the nature of the oscillation changes. Analysis of the oscillation frequency yields information on
- 30 an area surrounding the array. The range, sensitivity and nature of information extracted from the signal can vary with the characteristics of the component parts.

Microwave devices have been used in security alarm systems, such as car alarms. They create a field within the body of a vehicle which when disturbed activates an alarm.

5 Brief Description of Invention:

It is an object of this invention to provide a proactive means of detecting movement within the vicinity of an open fire. This overcomes some of the disadvantages of a conventional fireguard as described previously. It provides additional security in the presence of a  
10 fireguard.

In particular, it is an object of this invention to provide an electronic fire guard, which does not present a physical barrier around a fire.

15 In addition, it is an object of this invention to provide an electronic fire guard that does not inhibit the radiation of heat produced by a fire into the surrounding area.

It is a further object of this invention to provide a means of alerting someone when an object or person has entered into a pre-set area surrounding a fire.

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The device according to the present invention will detect any attempt to get within an unsafe distance of the fire. The basis of the invention, as represented by a first embodiment, is a device that would be fitted above a fire alcove, typically to the underside of the mantelpiece and forms an invisible protective envelope around the fire area. Any movement within this  
25 envelope will be detected and will sound an audible alarm and / or may cause a warning indicator to be activated.

In another embodiment of the present invention there is an in-built radio transmitter which will send a signal to a plug-in stand alone radio receiver, which can be located in another  
30 room. Typically this would be used in a domestic situation where children occupy a sitting room with an open fire, but the guardian or supervising adult is working in another room in the dwelling such as the kitchen. The remote monitor could then be plugged into a point in

the kitchen and if any attempt were made to tamper with the fire in the sitting room, it would sound an audible and / or visual alarm in the kitchen as well as in the room with the open fire.

5 An electronic fire guard according to the present invention comprises of a sensor positioned in the vicinity of a fireplace and a means of alarm, the sensor having transmitting and receiving means, for generating and monitoring an electromagnetic field around said sensor, wherein the sensor causes the alarm means to be activated when a disturbance in the electromagnetic field is detected.

10 The present invention also provides for the use a field disturbance device, located in the vicinity of a fire place, and in conjunction with alarm means, as a fire guard wherein, the field disturbance device establishes an electromagnetic field around the fire place and disturbance of this field causes the alarm means to be activated.

15 Description of Drawings Attached:

The electronic fire guard according to the present invention will be described in further detail with respect to the drawings in which:

20 Figure 1 is a schematic drawing of a first embodiment of the present invention; and

Figure 2 shows the external appearance of the sensor unit; and

25 Figure 3 is a schematic drawing of a second embodiment of the invention in which a remote alarm unit is located at a distance from the sensor.

Figure 4 shows the external appearance of a remote unit; and

Detailed Description of the Invention:

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A number of different embodiments of the electronic fire guard will be described. The first embodiment consists of a stand-alone system, which comprises in-built audio and or visual

indicators to indicate that the protected space has been violated. The second embodiment comprises an in-built radio transmitter that communicates with a receiver module that is located within radio range of the transmitter.

- 5 Both of the embodiments may be powered by standard battery cells and / or will have a power jack that can be used with a battery eliminator such as a plug-in power pack. The battery compartment may be accessed via a hatch in the side of the unit.

The device according to the first embodiment of the invention typically has two actuators,  
10 two indicators and an audio generator. The actuators are typically a switch and a button. The indicators are typically LED's (light emitting diodes) that are coloured green and red. The audio generator is typically a piezo-buzzer. The switch when activated applies power to the unit. The green LED illuminates for a pre-set period to indicate that the power level is within acceptable tolerances. Should the power level be insufficient to run the unit then the  
15 green LED will flash and a pulsed tone will be emitted by the buzzer to indicate lack of power. The unit tests the power level at pre-set intervals while powered up. Should the power levels become insufficient for operation then the green LED will flash and a pulsed tone will be emitted by the buzzer to indicate lack of power. After application of power and the first power test then the unit will enter an armed mode. During armed mode the  
20 microwave field is present and being sensed. If no movement is detected then no LED's are illuminated and no sound generated. Should movement be detected while in armed mode then the red LED will flash and the buzzer sound to indicate alarm. This will continue for a pre-set period. Should movement still be present after this period then another period of red LED flashing and buzzer sounding will be entered. If movement is not detected after and  
25 alarm period then the unit returns to armed mode. If the button is pressed while the unit is powered then the unit will enter a muted mode for a pre-set period. While in muted mode the red LED will flash and the buzzer will generate a pulsed tone. The muted mode buzzer sound will be different and quieter than an alarm mode buzzer sound. The unit will return to alarm mode after the pre-set period. The use of the muted mode would typically be in order  
30 to allow a responsible individual access to the open fire without the inconvenience of a loud buzzer sounding. They may need to enter the vicinity of the open fire occasionally in order to stoke or add fuel to the fire.

One or more methods of motion detection may be used to detect movement within the protected area. The preferred motion detection method is known as a 'field disturbance device'. This utilises the 'Doppler effect', which describes a shift in the frequency of a continuous wave emitted by a moving source when observed from a stationary point. The sensing device uses a microwave oscillator of whose resonant frequency is affected by objects of sufficient mass and velocity moving within the range of the oscillator. The frequency shift is proportional to the velocity and mass of the object within its range.

10 The microwave motion detector part of the circuit consists of an antennae, local oscillator, mixer and signal processing circuitry. The antenna is fabricated on the PCB (printed circuit board) allowing the device to be small and compact. The antennae, local oscillator and mixer circuitry is positioning and PCB tracking is designed in such a fashion as to produce a device with field shaping, response and sensitivity suitable for this use. Signals from the detector  
15 are processed and analysed to determine if an alarm condition should be set. If an alarm condition is set i.e. by the detection of a disturbance in the field of the device, an audible alarm and /or the alarm LED will be activated. The audible alarm typically consists of a piezo-buzzer or some other appropriate audio device. Once an alarm condition has been set, it will remain in alarm mode for a predetermined period after which it will return to normal  
20 operation.

Other methods of motion detection such as passive infrared, short wave radar or light emitter / receiver devices may be used for motion detection.

25 A second embodiment of the present invention, as well as comprising the above mentioned characteristics further comprises a remote alarm unit. In this second embodiment, an in-built radio transmitter may be employed in the sensor unit to transmit a signal to the remote alarm unit, which has a in-built radio receiver. The remote alarm may typically comprise a plug-in module, which will plug into a standard power point. It will typically consist of a plastic unit  
30 which houses a power supply, radio receiver module and an audio device such as a piezo-buzzer.

The device according to the second embodiment has three indicators, typically LED's, labelled 'power', 'armed' and 'alarm', coloured green, yellow and red respectively. The green power LED illuminates once the receiver is powered up, i.e. plugged into a power point. The yellow armed LED illuminates once the remote unit receives a signal from the main module confirming that it is switched on and in detect mode. When the main module is switched off the armed LED on the receiver module will not illuminate. It is therefore possible to tell from the remote unit if the main unit is armed. The red alarm LED flashes in sequence with the alarm LED on the main unit.

Turning now to the diagrams, Figure 1 is a schematic diagram of the manner in which the sensor of the present invention may typically be used. The electronic fire guard sensor (1) is typically located on, or underneath, the mantle piece of the fireplace (2). The sensor (1) may be located in an alternative position so long as this does not prejudice the operation and area coverage of the device. The sensor (1) comprises a local oscillator / transmitter arrangement (not shown) which generates and transmits a signal, setting up a field (indicated by the shaded region (3) around the sensor (1) and the fireplace (2) as described in the prior art section above. Preferably, the local oscillator produces a microwave signal, although an infrared signal may be used as an alternative. Once the sensor (1) is operational and the protected field (3) is established, any motion, caused for instance by a person or an object moving in the vicinity of the fireplace (2), which disturbs the field (3) will cause an alarm to be activated. This alarm may be audio and / or visual in nature. In a preferred embodiment, both audio and visual alarm means are incorporated into the device. The shape of the field generated by the device is approximately hemispherical in nature. A hemispherical field is projected in front of the sensor. A hemispherical field approximately one-tenth the radius is projected behind the sensor. Also shown in Figure 1 is the remote alarm unit (4) from the second embodiment while is located within radio reception range of the sensor unit (1).

Figure 2 shows in more detail the external appearance of the electronic fire guard sensor. The casing containing the electronic components (not shown) for generating and transmitting the microwave signal also houses a number of switches. The power switch (5) controls the power input to the device. A "silent mode" or mute mode button (10) may optionally be provided so that, when depressed, the audio alarm, typically a buzzer of some description, is



temporarily disarmed. A first light emitting diode (LED) (7) is provided to indicate when the power switch (5) is in the "on" position. A second LED may be provided to indicate when the device is operating in "silent" mode. Alarm means may comprise a buzzer (9) or a flashing LED (not shown).

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In a second embodiment, shown in Figure 3, the fire guard sensor of the present invention further comprises a remote alarm (11) which may be located remote from the sensor (1) and which communicates with said sensor (1) via appropriate circuitry (not shown) in both components ((1) and (11)). In this instance an alarm such as a buzzer, or a flashing LED is  
10 activated in the remote alarm, which may for instance be located in a different room from the fire, the fireplace (3) and the sensor (1), alerting a person in the vicinity of said remote alarm (11) to the fact that the sensor (1) has detected some motion in the field (4) around the fireplace (3). Appropriate action may then be taken.

15 A suitable means of encoding may be incorporated to ensure that devices according to the invention in close proximity to each other do not cross talk. That is a remote unit responds only to communications originating with a paired sensor unit.

## Claims:

Claim 1. An electronic fire guard positioned in the vicinity of a fireplace comprising a sensor and alarm means, the sensor having transmitting and receiving means, for generating and  
5 monitoring an electromagnetic field around said sensor, wherein the sensor causes the alarm means to be activated when a disturbance in the electromagnetic field is detected.

Claim 2. Use a field disturbance device, located in the vicinity of a fire place, and in conjunction with alarm means, as a fire guard wherein, the field disturbance device  
10 establishes an electromagnetic field around the fireplace and disturbance of this field causes the alarm means to be activated.

Claim 3. An electronic fire guard according to claim 1 wherein the electromagnetic field is a  
15 microwave field.

Claim 4. An electronic fire guard according to either of claims 1 or 2 wherein the alarm means is located remote from, and is in communication with, the sensor.

Claim 5. A fire guard substantially as shown in, and as described with reference to, the  
20 accompanying drawings.

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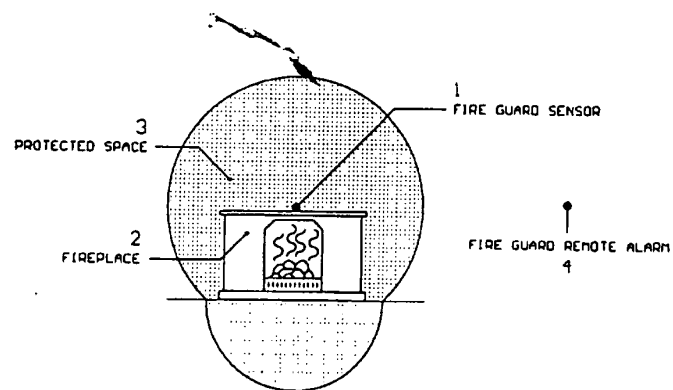


Figure 1

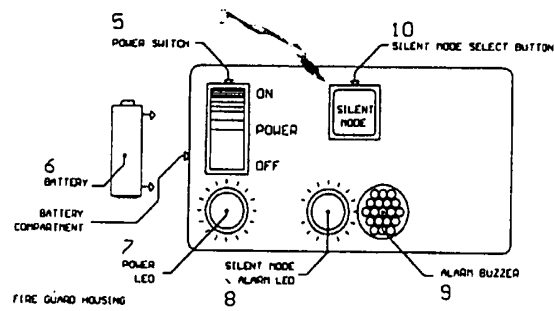


Figure 2

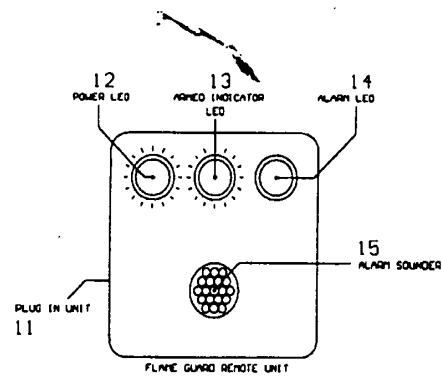


Figure 3